In re Patent Application of
MONTGOMERY
Serial No. 10/631,271
Filed: JULY 31, 2003

In the Claims:

This listing of claims replaces all prior versions and listing of claims in the application.

1. (Currently amended) An optical profile determining apparatus comprising:

an optical detector;

an optical source for generating a transmit beam comprising a plurality of wavelengths, and for generating a reference beam comprising the plurality of wavelengths; ~~and~~

at least one optical element for directing the transmit beam to a target, for directing a resulting reflected transmit beam back from the target to said optical detector, and for combining the reference beam with the reflected transmit beam so that a profile of the target is based upon fringe contrast produced by the plurality of wavelengths in the reference beam and the plurality of wavelengths in the reflected transmit beam; and

a plurality of spaced apart reflectors at the respective predetermined locations on the target for providing the reflected transmit beam;

said at least one optical element including

a first lens for colliminating the transmit beam,

a lenslet array downstream from said first lens for directing the transmit beam toward the target, and

a second lens downstream from said lenslet array for projecting the transmit beam onto the target at predetermined locations thereon.

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2. (Original) An apparatus according to Claim 1 wherein said optical source comprises:

a plurality of lasers for generating a plurality of individual transmit beams, each laser operating at a different wavelength; and

a multiplexer for multiplexing the plurality of individual transmit beams into a combined transmit beam.

3. (Original) An apparatus according to Claim 2 wherein said optical source further comprises:

a splitter downstream from said multiplexer for splitting the combined transmit beam into a first beam and a second beam, the first beam defining the transmit beam; and

a delay circuit downstream from said splitter for delaying the second beam to define the reference beam.

4. (Previously presented) An apparatus according to Claim 1 wherein said optical source provides a tilted wavefront of the reference beam directed to said optic al detector with respect to a wavefront of the reflected transmit beam directed to said optical detector.

5. (Canceled).

6. (Canceled).

7. (Currently amended) An apparatus according to Claim 1 ~~6~~ wherein said optical detector comprises a processor

for computing a distance to the target for each reflector based upon a corresponding fringe contrast associated therewith for determining the profile of the target.

8. (Currently amended) An apparatus according to Claim 1 ~~6~~ wherein said lenslet array comprises a plurality of lenses, each lens being associated with a respective reflector.

9. (Original) An apparatus according to Claim 1 wherein said at least one optical element comprises a mirror having an opening therein for receiving the transmit beam and the reference beam, said mirror also directing the reflected transmit beam to said optical detector.

10. (Original) An apparatus according to Claim 9 wherein said at least one optical element further comprises an imaging lens for directing the reflected transmit beam and th e reference beam to said optical detector.

11. (Original) An apparatus according to Claim 1 wherein said optical detector comprises a processor for computing a distance to the target based upon an amplitude of the fringe contrast.

12. (Original) An apparatus according to Claim 11 wherein said processor computes the distance to the target using the amplitude of the fringe contrast in a ratio of a peak-to-peak variation in intensity to an average intensity.

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13. (Original) An apparatus according to Claim 1 wherein said optical detector comprises a charge-coupled device (CCD).

14. (Original) An apparatus according to Claim 13 wherein the profile of the target is based upon a single exposure of said CCD.

15. (Currently amended) An optical profile determining apparatus comprising:

an optical detector;

a plurality of lasers for generating a plurality of individual transmit beams, each laser operating at a different wavelength;

a multiplexer for multiplexing the plurality of individual transmit beams into a combined transmit beam;

a splitter downstream from said multiplexer for splitting the combined transmit beam into a first beam and a second beam, the first beam defining a transmit beam;

a delay circuit downstream from said splitter for delaying the second beam to define a reference beam; ~~and~~

at least one optical element for directing the transmit beam to a target, for directing a resulting reflected transmit beam back from the target to said optical detector, and for combining the reference beam with the reflected transmit beam so that a profile of the target is based upon fringe contrast produced by the plurality of wavelengths in the reference beam and the plurality of wavelengths in the reflected transmit beam; and

a plurality of spaced apart reflectors at the respective predetermined locations on the target for providing the reflected transmit beam;

said at least one optical element including

a first lens for colliminating the transmit beam,

a lenslet array downstream from said fir st lens for directing the transmit beam toward the target, and

a second lens downstream from said lenslet array for projecting the transmit beam onto the target at predetermined locations thereon.

16. (Original) An apparatus according to Claim 15 wherein the reference beam directed to said optical detector has a wavefront that is tilted with respect to a wavefront of the reflected transmit beam directed to said optical detector.

17. (Canceled).

18. (Canceled).

19. (Currently amended) An apparatus according to Claim 16 ~~18~~ wherein said optical detector comprises a processor for computing a distance to the target for each reflector based upon a corresponding fringe contrast associated therewith for determining the profile of the target.

20. (Currently amended) An apparatus according to Claim 16 ~~18~~ wherein said lenslet array comprises a plurality of lenses, each lens being associated with a respective reflector.

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21. (Original) An apparatus according to Claim 15 wherein said at least one optical element comprises a mirror having an opening therein for receiving the transmit beam and the reference beam, said mirror also directing the reflected transmit beam to said optical detector.

22. (Original) An apparatus according to Claim 21 wherein said at least one optical element further comprises an imaging lens for directing the reflected transmit beam and the reference beam to said optical detector.

23. (Original) An apparatus according to Claim 15 wherein said optical detector comprises a processor for computing a distance to the target based upon an amplitude of the fringe contrast.

24. (Original) An apparatus according to Claim 23 wherein said processor computes the distance to the target using the amplitude of the fringe contrast in a ratio of a peak-to-peak variation in intensity to an average intensity.

25. (Original) An apparatus according to Claim 15 wherein said optical detector comprises a charge-coupled device (CCD).

26. (Original) An apparatus according to Claim 25 wherein the profile of the target is based upon a single exposure of said CCD.

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27. (Currently amended) A method for determining a profile of a target comprising:

generating a transmit beam comprising a plurality of wavelengths, and generating a reference beam comprising the plurality of wavelengths;

directing the transmit beam to a target;

directing a resulting reflected transmit beam back from the target to an optical detector; and

combining the reference beam with the reflected transmit beam so that a profile of the target is based upon fringe contrast produced by the plurality of wavelengths in the reference beam and the plurality of wavelengths in the reflected transmit beam;

wherein directing the transmit beam and the resulting reflected transmit beam is performe d using at least one optical element including

a first lens for colliminating the multiplexed transmit beam,

a lenslet array downstream from the first lens for directing the transmit beam toward the target, and

a second lens downstream from the lenslet array for projecting the transmit beam onto the target at predetermined locations thereon;

wherein a plurality of spaced apart reflectors are at the respective predetermined locations on the target for providing the reflected transmit beam.

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28. (Original) A method according to Claim 27 wherein generating the transmit and reference beams comprises:

generating a plurality of individual transmit beams using a plurality of lasers operating at different wavelengths;

multiplexing the plurality of individual transmit beams into a combined transmit beam;

splitting the combined transmit beam into a first beam and a second beam, the first beam defining the transmit beam; and

delaying the second beam to define the reference beam.

29. (Previously presented) A method according to Claim 27 wherein a wavefront of the transmit beam being directed to the optical detector is tilted with respect to a wavefront of the reflected transmit beam being directed to the optical detector.

30. (Canceled).

31. (Canceled).

32. (Currently amended) A method according to Claim 27 ~~30~~ further comprising computing a distance to the target for each reflector based upon a corresponding fringe contrast associated therewith for determining the profile.

33. (Currently amended) A method according to Claim 27 ~~31~~ wherein the lenslet array comprises a plurality of lenses, each lens being associated with a respective reflector.

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34. (Original) A method according to Claim 27 further comprising directing the transmit beam and the ref erence beam through an opening in a mirror, the mirror also for directing the reflected transmit beam to the optical detector.

35. (Original) A method according to Claim 27 further comprising computing a distance to the target based upon an amplitude of the fringe contrast.

36. (Original) A method according to Claim 35 wherein computing the distance to the target includes using the amplitude of the fringe contrast in a ratio of a peak -to-peak variation in intensity to an average intensity.

37. (Original) A method according to Claim 27 wherein the optical detector comprises a charge -coupled device (CCD).

38. (Original) A method according to Claim 37 wherein the profile of the target is determined based upon a single exposure of the CCD.

39. (New) An optical profile determining apparatus comprising:

an optical detector;

an optical source for generating a transmit beam comprising a plurality of wavelengths, and for generating a reference beam comprising the plurality of wavelen gths; and

at least one optical element for directing the transmit beam to a target, for directing a resulting reflected transmit beam back from the target to said optical detector, and for combining the reference beam with the reflected transmit beam so that a profile of the target is based upon fringe contrast produced by the plurality of wavelengths in the reference beam and the plurality of wavelengths in the reflected transmit beam, said at least one optical element comprising a mirror having an opening therein for receiving the transmit beam and the reference beam, said mirror also directing the reflected transmit beam to said optical detector.

40. (New) An apparatus according to Claim 39 wherein said at least one optical element further comprises a n imaging lens for directing the reflected transmit beam and the reference beam to said optical detector.

41. (New) An optical profile determining apparatus comprising:

an optical detector;

a plurality of lasers for generating a plurality of individual transmit beams, each laser operating at a different wavelength;

a multiplexer for multiplexing the plurality of individual transmit beams into a combined transmit beam;

a splitter downstream from said multiplexer for splitting the combined transmit b eam into a first beam and a second beam, the first beam defining a transmit beam;

a delay circuit downstream from said splitter

for delaying the second beam to define a reference beam; and

at least one optical element for directing the transmit beam to a target, for directing a resulting reflected transmit beam back from the target to said optical detector, and for combining the reference beam with the reflected transmit beam so that a profile of the target is based upon fringe contrast produced by the plurality of wavelengths in the reference beam and the plurality of wavelengths in the reflected transmit beam, said at least one optical element comprises a mirror having an opening therein for receiving the transmit beam and the reference beam, said mirror also directing the reflected transmit beam to said optical detector.

42. (New) An apparatus according to Claim 41 wherein said at least one optical element further comprises an imaging lens for directing the reflected transmit beam and the reference beam to said optical detector.

43. (New) A method for determining a profile of a target comprising:

generating a transmit beam comprising a plurality of wavelengths, and generating a reference beam comprising the plurality of wavelengths;

directing the transmit beam to a target;

directing a resulting reflected transmit beam back from the target to an optical detector; and

combining the reference beam with the reflected transmit beam so that a profile of the target is based upon fringe contrast produced by the plurality of wavelengths in the

reference beam and the plurality of wavelengths in the reflected transmit beam;

wherein the transmit beam and the reference beam are directed through an opening in a mirror, the mirror also for directing the reflected transmit beam to the optical detector.

44. (New) The method according to Claim 42 wherein the reflected transmit beam and the reference beam are directed to the optical detector with an imaging lens.